THE PRACTICE OF SUSTAINABLE EDUCATION THROUGH A PARTCIPATORY AND HOLISTIC TEACHING APPROACH

Michael Herrmann

Summary

As the concept of sustainable development has become established as a priority that underpins future social and economic development, so there naturally follows the expectation that there will be an effective implementation of curricula for sustainability within higher education.

At the heart of the pedagogical approach described here is an emphasis upon experiential learning, whereby students engage creatively with their own immediate environment. The subject matter to which their attention is applied is the physical and cultural environment of their own university; the spaces that they inhabit and the systems of which they are a part. This is not merely a matter of convenience, but stems from the view that education for sustainability as the mere accumulation of knowledge about environmental problems is ineffective and can even be disempowering. Effective learning about sustainability involves the first-hand experience of issues coupled with efforts to put the theories of sustainability into practice.

The Context: Sustainability and Higher Education

As the environmental and social impacts of industrialisation have begun to dawn on the global consciousness, we may be witnessing the birth of a new, post-modern ecological worldview, and the burgeoning awareness of the implications of the new touchstone, 'sustainable development'. Governments, public bodies and the commercial and corporate worlds have begun the process of commitment to the principles and purposes of the triple bottom line of sustainability.

Leading theorist on Sustainable Education, Stephen Sterling, (2002: 4) maintains that we need to "purposefully accelerate the process of cultural evolution and deep learning in Western consciousness". From this standpoint, "a 'learning society' is one that seeks to understand, transcend, and re-direct itself through intentional learning". (Sterling 2003: 99) As our universities and institutions of higher education are the breeding grounds and repositories of knowledge, nurturing the future thinkers and decision makers of politics and industry, it is imperative that the education sector responds to this agenda.

It is suggested here that to do so we need to adopt transformative teaching and learning strategies. This may well represent a challenge to the established and traditional teaching methodology. Any challenge to the status quo that involves meaningful change in the relationship between educators and their students may prove uncomfortable and is likely to be met with apathy or even resistance in some quarters. However, as the English saying goes, there is no gain without pain. Woodrow Wilson, twenty-eighth President of the USA elaborated on this truism when he said that "if you want to make enemies, try to change something." It may be no surprise then to discover that, in the UK at least, a recent review demonstrates a patchy response within Institutions of Higher Education to the twin imperatives of adoption of sustainable practices and the teaching of sustainablity. Good practice is often largely credited to the presence of one or two key 'sustainability champions' within an institution (Richardson et al 2005), and an optimum methodology for teaching the sustainability agenda is far from clear. At the heart of the approach discussed here is a pedagogical perspective that emphasises the need for students to engage actively and creatively with their own curriculum and the immediate environment.

Sustainability has become a buzzword, used with such frequency, and to justify such wide-ranging issues that there is a risk that it risks losing clear meaning and relevance to the average citizen, certainly the average student. However, as the US architect and champion of sustainable design, William McDonough (2000), has pointed out, "all sustainability is measured at the local level"; it is the collective actions and experiences of individuals that contribute to the 'bigger picture'. Through direct contact with, and experience of, the context, the place, and even implementation and monitoring of a proposed 'solution', students can experience what is meant by this word of which they now hear so much, and can consider what actions are open to them in response. The US educationalist David Orr has also observed this; "The study of environmental problems is an exercise in despair unless it is regarded as only a preface to the study, design, and implementation of solutions." (Orr 1992) Traditionally, environmental education programs have limited their activities to the promotion of environmental knowledge and understanding. By themselves these elements do not necessarily to lead to the development of a citizenry that is capable of resolving environmental problems. Sterling (2001: 19) suggests that it isn't just about matching actions to words, but also about the depth of learning (understanding). He too suggests that too much environmental knowledge can be disempowering without a deeper and broader learning process taking place, and expands on this by distinguishing between first-order learning, which is adaptive, and tends to leave assumptions unchallenged, and second-order learning that involves critical reflection that begins to question these assumptions. He goes on to describe the deepest level as third-order learning; where core values are challenged and basic assumptions about the world can be reconceived. He suggests that these higher orders of learning are transformative in nature.

Towards Transformative Education: Using Learning from Experience

"I hear and I forget, I see and I can remember, I do and I understand."
(Chinese proverb)

Human beings learn from experience. As infants we watch our parents and the world before us, developing our understanding of the links between cause and effect. As adults we continue to develop our knowledge base through an accumulation of first hand experience. We seem to remember best the lessons 'learnt the hard way', striving to learn from our mistakes. As we learn, our minds depend on the building of links between experiences and memories, making connections between our rational, deductive faculties and our sensual perception. Rather than the apparently abstract information given to us by our parents, these first hand lessons are the ones that we are likely to remember forever more, the knowledge upon which we which we continue to construct our own personal understanding of the world.

Kolb (1984: 38) usefully identified some of the features that distinguish and characterise the experiential learning pedagogy discussed here:

- The involvement of the whole person (intellectual and sensory faculties as well as emotional responses)
- An active use of all previous relevant life and learning experiences
- Reflection upon earlier experiences so as to allow an evolution of thought and hence a deeper understanding

This represents a more rounded and considered approach to sustainable education, a principle that was recognised in a report produced by the Design Council (Richardson *et al* 2005), intended to inform UK government policy: "Given the broad nature of sustainable development considerations, an holistic approach to the subject is necessary." The adoption of an holistic approach may challenge the traditional relationship between teacher and learner. The processes required for transformative education have been described by Sterling (2001: 38-40) as both constructive (as opposed to Instructive), and participative (as opposed to imposed). By way of contrast, commenting on recent developments in Western education systems, he draws an analogy with the factory; "Young people and qualifications are produced; there are precise goals and targets; the curriculum provides directives for each stage of production; and teachers are technicians and are therefore substitutable. And workers are not required to think too much." This does not describe the progressive education system that is demanded if we are to equip society with individuals capable of dealing with the crises that may unfold over the coming years.

In terms of the teaching of sustainability issues, to not just facilitate, but to accelerate the societal adjustments necessary for progress towards an equitable and sustainable future, learners need to acquire at least a certain basic level of 'ecological literacy'. Only then can they engage in a meaningful way with personal responsibility, as well as propose

progressive actions for their own educational institution. The essential aim of ecological literacy, as described by the American educationalist David Orr (1992), is to foster "that quality of mind that seeks out connections." Running counter to what he sees as the over-specialisation and narrowness of most education, ecological literacy "implies a broad understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainably." (Orr 1992) Ecological literacy is therefore about making mental associations; not least realising the interdependence of human and ecological systems. As it rarely happens that sustainability issues are written into curricula at the primary and secondary school levels, it falls to the hands of educators in Higher Education to attempt to inculcate this eco-literacy. (Richardson *et al* 2005: 106) Only with this as a prerequisite can the learning processes of the students be accelerated towards a deeper comprehension of the ways that they can contribute to the goals of sustainable development, and really 'get to grips' with an exploration of meaningful solutions.

The adoption of a more holistic approach to education for sustainability is also likely to demand that consideration be given to the environment in which students engage in the learning process. This is considered further in the section on learning environments, as well as in the Genereric Recommendations section.

The Potential for Synergy: Greening Teaching, Greening Colleges

In September 2004, the British Prime Minister, Tony Blair, said that "Every school should also be an environmentally sustainable school, with a good plan for school transport that encourages walking and cycling, an active and effective recycling policy, and a school garden or other opportunities for children to explore the natural world. Schools must teach our children by example as well as by instruction." The UK Government Department for Education and Skills now states that it is committed to the principle that "Sustainable development will not just be a subject in the classroom: it will be in its bricks and mortar, and the way the school uses and even generates its own power. Our students won't just be told about sustainable development, they will see and work within it: a living, learning, place in which to explore what a sustainable lifestyle means." (DFES) Should our institutions of Further and Higher Education not also demonstrate the same good practice, and also aim to 'lead by example'?

Tom Kelly, Director and Secretariat of University Presidents for a Sustainable Future in the USA points out the danger of not responding;

> *"While our attention focuses on formal curricula…our students are learning a great deal from the way our institutions are structured, their patterns of consumption and production of waste, and the relationships they have with the local, regional, and international community. This shadow curriculum is a constant, repetitive, and often unconscious educational force...in many cases working against the very principles of environmental literacy that we seek to engender in our students."*
>
> (Kelly cited Grant 1999)

He realises the potent resource that is offered through study and action initiatives in relation to campus management, maintaining that;

> *"Campuses are overflowing with examples of ecologically irrational practices that are often economically and socially unsound as well. By identifying and analysing those examples, formulating responses, and participating in their implementation, students are empowered and emboldened to take on issues of institutional change."*
> (Kelly cited Grant 1999)

Colleges and universities are leverage institutions. They can help create a humane and liveable future, rather than remaining passively on the sidelines, waiting to study the outcome. (Orr 1992) We do however need to learn lessons from the accumulating experience in the delivery of 'campus ecology' programmes in the UK and USA over the last 15 years. The term 'campus ecology', originating in the USA, refers to campus-based experiential issue investigations, used as a context in which students can learn the requisite skills for society to develop an environmentally literate citizenry. (Einstein 1993) The study of resource flows within an institution offers the most tangible link between the activities of an educational institution and the world beyond. Whilst they are usually 'out of sight and out of mind', there is great potential benefit to their study. The survey and analysis of the use of human behaviour, energy, water, materials, food, waste flow, architecture, and landscape architecture can all offer excellent vehicles for both broadening and deepening comprehension of ecology, as well as for the subsequent development of appropriate and alternative responses. These can then go on to inform the development of institutional sustainability policies.

A course project may involve students defining a problem or opportunity and then investigating and presenting possible solutions. Given the diverse nature of the sustainability agenda, during the course of their work, it is almost inevitable that students will have some involvement with a wide range of university staff, from human resources through finance and purchasing departments, to the management team and estates staff such as cleaners. In the process they benefit hugely through involvement with a project that has the capacity to create an awareness of systems design and the process of effecting significant change at both individual behavioural and institutional levels. The non-academic staff can gain insight into the activities of the students and lecturers, and quite possibly, exposure to new (and progressive) concepts and information. In the author's experience it is feasible that ideas generated by undergraduates can actually go on to inform senior management decision-making and lead to positive changes in institutional behaviour. An example of this was the virtual 'dematerialisation' of the 'freshers' pack' offered to new students to Leeds Metropolitan University following a student's proposal.

One of the defining characteristics of experiential learning is to change some aspect of behaviour. (Dennison and Kirk 1990) In a higher education context, this may require the co-operation of influential institutional forces, such as management and campus staff. Although raising environmental awareness is likely to be a primary objective, initiatives and proposals that fall victim to the inertia or antagonism of bureaucracy can do more harm than good. Learning focussed on sustainable practice will be undermined and even

negated by apparent environmentally insensitive behaviour. (Ali Khan 1995) For the sake of motivation and morale, students need to perceive activity as purposeful and effective. Institutional efforts to involve students must be whole hearted and serious, and in 'preparing the ground' it is thus important for teaching staff to secure the support of senior and middle management, as well as of campus operators and service staff. Another important consideration is to attempt to provide some mechanism for cohorts of students to pass on projects that have begun, or that show promise, from one year to the next. If 'greening' is not just an intellectual exercise but a real cultural change, it is important to know power to integrate these strands symbiotically. (T. Alabaster & D. Blair in Huckle & Sterling 1996: 98-99) A part of the challenge to the status quo is that innovative change, whilst appealing in theory, may be seen as radical and thus difficult to construct and implement, not least as universities tend to be conservative, bureaucratic and traditional institutions where change is implemented via formal and established structures, and from the 'top down'. (Alabaster & Blair in Huckle & Sterling 1996: 102-103) While creative innovation and 'bottom-up' experiments are possible, they often depend on the efforts of individual 'champions' and voluntary enthusiasm, both of which may be transitory. Environmental responsibility is neither a top-down nor a bottom-up issue but is a shared responsibility for each individual member of that institution. (T. Alabaster & D. Blair in Huckle & Sterling 1996: 102-103)

An experiential learning sustainable education model can thus offer mutual benefits to both the delivery of the curriculum and the institution itself. This synergy is released by inviting students to examine their 'own back yard' and then present these research findings and offer free and possibly innovative suggestions to the institution. As such it has similarities with the Japanese style of management with a feedback mechanism by way of information flowing from the bottom up. The potential positive effects and mutual benefits can ripple out to all stakeholders: individual staff and students, as well as to the supporting residential and business communities.

Learning Environments

According to Beard and Wilson (2001), we have a poor understanding regarding the impact of the complex interactions that take place within the learning environment. We are however seeing a gradual change, with transformations in the design and specification of the lecture theatres and teaching spaces; perhaps a reflection of the trend of recent years towards increasingly flexibility in terms of work and living patterns and spaces, even knowledge and artefacts.

In the UK, a Design Council report 'Kit for Purpose: Design to Deliver Creative Learning' (2002) notes that traditional learning environments tend to:

- Reduce the range of teaching and learning styles possible and affect the interaction between teacher and student
- Undermine the value placed on learning
- Do not adapt to individual needs

- Hinder creativity
- Be inefficient, wasting time and effort
- Cost more in the long term

One alternative, particularly useful in experiential learning (for sustainable education) is to use the outdoor campus. The efficacy of the educational experience can, at times, be greatly enhanced by simply taking teaching into more informal, mood enhancing learning environments, and none offers greater potential benefits than the 'outdoor classroom'. Simply 'being' in nature as the learning environment is a powerful experiential intervention in itself. (Beard and Wilson 2001) Perhaps what matters most is that learning takes place in an inspiring and stimulating enviroment, even if outside in the built (urban) environment. In the author's teaching experience, students report feeling more creative when working in outdoor spaces. If it is innovative and radical solutions that the world needs, then the importance of unleashing creativity should not be underestimated. As Albert Einstein once said, imagination is more important than knowledge.

David Orr (1992) elaborates on these themes, stating that "the way education occurs is as important as its content", and that "environmental education ought to change the way people live, not just how they talk." The need for access to the 'outdoor classroom' is further enforced by Orr when he claims that; "Experience in the natural world is both an essential part of understanding the environment, and conducive to good thinking… knowledge of a place – where you are and where you come from – is intertwined with knowledge of who you are. Landscape, in other words, shapes mindscape." The direct access by students to nature spaces was recognised by the UK Design Council (Richardson *et al* 2005), when it is stated that, "students discover for themselves the benefits of taking first-hand and researched observations of nature as inspiration for the design of solutions our common future."

Case Study 1

Experiential Learning Environments

For more than thirty years students in the Leeds Metropolitan University School of Architecture, Landscape and Design have had use of a 'place to play in the woods'; the Landscape Resource Centre. This is a one-hectare demonstration garden that offers a flexible and relaxed learning environment. Here more than anywhere else that they study, students can 'let their hair down' and explore ideas in three dimensions and as well as find inspiration in the stuff of nature.

The evidence of generations of creativity and experimentation with materials creates a palimpsest as the 'experiments' spill one into the next, sometimes complementing the next, other times cannibalising each other in a re-cycling of materials, techniques and ideas that feed creative inspiration. The designs have either aged gracefully (as ivy creeps along the flaking red and green paint of a timber Japanese style bridge over one of several ponds), or

failed spectacularly, remaining as evidence of ambitious explorations at the limits of design possibility (or even aesthetic acceptability!). Visit in the winter and you may see the badgers or foxes in the frosty woods, visit in spring or summer and witness the bee hive buzzing and the trees and bushes alive with bird song. Lectures and workshops take place in the central timber classroom, with its copious windows looking out onto lush greenery. The gardens are used by students of various courses for "hands-on" practical experience and for experimental project work of all scales.

In the words of Senior Lecturer, Alistair Baldwin; "The interesting thing about the place is that, despite the fact that parts of it are positively unkempt, it has an appeal amongst the students, as it is so different to their normal city-based learning environment; the students perceive the centre more as 'not city centre campus' than anything else. The fact that they get fresh air, contact with nature, enclosure by trees and the sounds of nature seems more important than the visual quality of the place." Perhaps its efficacy has got a lot to do with its contrast to their 'normal' living and working environments – an escape to somewhere green and relaxing where thoughts can flow more freely and the change of context can allow relationships between 'educators' and their students to be re-conceived. Ali Baldwin again; "The relaxed atmosphere has drawn from students quite uninhibited, creative expressions – the setting has a quality about it which does not intimidate the students and put them under pressure to walk the conventional line."

Figure 1: The Landscape Resource Centre occupies nearly a hectare of land in a woodland setting on the University's Beckett Park Campus.

During their third year of the BA (Honours) courses in Landscape Architecture and Garden Art and Design, students are required to participate in a module known as 'Design and Community' (D&C). This offers students and staff practical, community-based design experience. Offered to students since 1978, this design-and-build activity allows valuable 'hands-on' work experience as well as the opportunity to explore possibility in the

implementation of design ideas. As well as construction and maintenance practice, the students are involved with the consultation process, negotiating with a local school or community groups, attempting to reconcile and balance conflicting interests, and budgets, whilst involving their clients in the decision making process. In June 2004, the UK Landscape Institute awarded this university the prize for 'Best Community Involvement Scheme in the past 75 Years'.

Whilst this program is not primarily about the greening of Leeds Metropolitan University itself, occasionally student projects do focus on environmental improvements within the campus itself. An example of this was the design and construction of an outdoor classroom, complete with timber decking, seating, and nature study area. This was used as a resource within the teacher training courses taught at the University. More usually, the focus for a project is likely to be a space within local school grounds or residential centres. During the year the students work closely with the project, evaluating the potential of the site, developing design ideas through to the detailed design, construction proposals, and cost estimates. If time allows, students are often then able to consider procurement and purchasing issues, and move through to the on-site implementation of the scheme, sometimes working alongside contractors, or supervising and assisting a volunteer workers or school children. The Design and Community teams use the workshops, demonstration gardens, named plant collections and nursery at their Landscape Resource Centre to support its practical, community-based design projects.

By maintaining strong, working links with local government departments and local community groups and institutions, mutual benefits are experienced for the course, the students, and the organisations assisted. In terms of experiential learning, the teaching of sustainability issues is thoroughly embedded in the routine activities of the student project work. The undergraduates must necessarily consider the thoughts, feelings, and experience of those for whom they are designing; as well as addressing financial issues such as fundraising, and reducing costs when working to a tight budget. Of course ecological sustainability issues are also considered, from the sourcing of traditionally grown and crafted materials, through to the chemical free propagation reducing use of, and planting of herb and wildflower areas for nature study and contemplation.

Evidence of the efficacy of the use of a problem based and experiential learning methodolgy in this context remains anecdotal at this stage; further to the previous comments by Ali Baldwin, Trudi Entwistle, the Senior Lecturer responsible for the this experiential and 'problem based learning' activity, is extremely enthusiastic about the benefits to the students. Year after year she has observed the blossoming confidence apparent in their work following the 'Design and Community' activity. She points out that among the important skills they learn through this 'hands on' project work are team working, professional engagement (e.g. with clients, contractors, suppliers), presentation skills, and greater confidence and understanding in the appearance, specification and performance of materials. They also learn the value of accommodating user group feedback from the involvement of the community in the design development and then on-site implementation.

Figure 2: New seating areas created at Woodlands Primary School

Case Study 2

University Futures: A Student Project focussed on Institutional Environmental Performance

Also at Leeds Metropolitan University, during the second year of the BA (Honours) Design, students do a module that encourages a focus on environmental and social issues in their design work. Each year between since the 1999, this has encouraged a focus on institutional performance in relation to the triple bottom line of sustainability. The module encourages students to conduct their own primary research into the activities and behaviour of the institution, staff and fellow students. Students receive briefings from a variety of local and regional experts regarding waste, recycling, and ecological design issues, as well as talks from facilities management staff and lecturers from relevant disciplines, such as e-learning, sociology and other design areas such as landscape design and architecture, before finally settling on an area of focus for the development of design-led proposals for improvement.

An exhibition of the final design proposals (including system design) was viewed by invited guests that typically include the University's Environment and Purchasing Officer, a representative from the university's appointed waste management company, and senior management team members, right up the Vice Chancellor. In the past the best student work has also been selected for display during the university's 'Environment Week'. Each year there is students compete for the possibility of internal funding for further research and development of the most promising schemes. Over the years some of the student ideas and design proposals have been adopted and have fed into the estates management programme, thus serving as a positive influence upon university environmental policy and

overall performance. The university was the first in the UK to achieve the international environmental management performance standard of ISO 14001, and these curricular activities were submitted as a significant component of this successful application.

In order to investigate the efficacy of the pedagogical approaches adopted here, 41 of the 45 participating students responded to the same set of questions about their feelings towards University (design) project work immediately before, and then again shortly after their involvement with this project. The results prior to engagement with the project are in parentheses; these relate to their feelings towards design projects in general, up to that point in time. During the 2005-06 academic year, the majority, 73% (compared to 56% before), stated that they place a high to very high value on the opportunity to work on a 'live' project: one that will be seen by a true client, with the potential of adoption or support for further development of their proposal. A majority of 69% (23% before) also report high to very high levels of satisfaction at feeling they are able to make a positive contribution to the sustainability performance of the university. Anecdotal evidence included the feeling that many felt that involvement in this project meant that they could 'leave their mark' for future cohorts of students to appreciate. There was a general feeling that the research stage of the project (three weeks) allowed them the opportunity to engage with real issues, and thus appreciate how environmental and social issues are felt in actuality, not merely as abstract concepts taught in the classroom. This was confirmed by 83% reporting high to very high level of agreement with this hypothesis (beforehand only 17% felt that college projects allowed them this opportunity).

The results suggest that the nature of the activity itself (allowing design proposals to be presented to campus staff, management and estates development consultants), as well as the use of a participatory teaching and learning pedagogy was to some extent effective at fostering a 'sense of purpose' and empowerment. In terms of a more substantive empirical determinion of the efficacy of the learning of sustainable development issues, a larger sample size will be used, the results normailsed, and the effects measured over a longer time period to determine the 'depth' of the learning experience.

Figure 3: Students generate a huge variety of ideas that then gives the university estates staff and management food for though

Figure 4: A student's proposal for a university sponsored cycle product service system

Figure 5: A proposal for campus info system providing personalised messages and general announcements, including environmental tips, as well as encouraging exchange and sharing of information and material goods

Generic Recommendations

The following notes are based on a synopsis of the author's experience of using the pedagogical approaches described here with art and design students at two UK universities, over the last ten years, as well as from literature review. The degree of relevance to other student groups, institutions of higher education and cultural contexts is dependant on variables such as resources, staff and student experience, as well as institutional commitment. The recommendations are for courses that allow students to learn about sustainability through focus of research and/or activity on the sustainability of institutional practice.

- Secure the understanding and support of campus services staff and key institutional managers, and involve them in the programme if possible
- Establish a base room, if possible with resources and information on hand
- Encourage mixed discipline groups, each with three or four members
- Make explicit the assessment criteria from the outset, stress the reward process as much as results
- Ensure that all students are involved, identify 'slackers' early on and monitor more closely
- Include some instruction and discussion of inter-disciplinary and team working skills
- Allow students to 'take ownership' of their learning experience, assisting them in their definition of aims, milestones, and outputs
- Encourage and support any 'hands-on' environmental actions
- Try to ensure that big projects are passed on effectively from one class to the next
- Use visits, visiting speakers, past students, internet, and local (and national) networks and resources to demonstrate examples and previous experiences
- Try to ensure that there is sufficient time and finances to 'finish' projects
- Identify and discuss unrealistically raised expectations at the outset and during development of student schemes
- Ensure that good records of projects are kept for reference by future students groups and initiatives
- Celebrate and promote successes throughout the institution, as well as more widely within the sector: disseminate the findings, including both negative and positive experiences, analysis, and conclusions

Concluding reflections

The case studies of the author relate largely to experience working with students in the art and design fields, however, with a creative and inspired approach to the design of curricular activities, the 'stuff' of sustainable education must prove relevant and potentially an exciting challenge to students of all disciplines. Indeed, allowing students the opportunity to work in interdisciplinary groups can be one of the joys of setting up sustainable education projects. It is also a more accurate reflection of life in the workplace beyond graduation (Coppola, 1996; Cockrell *et al*., 2000), and will usually be relevant when seeking sustainable solutions, as environmental and social problems rarely fall neatly into the realm of any single professional vocation. Dawe *et al* (2005: 23) and Herrmann &

Mullins (2002) have emphasised the benefits of trans and inter-disciplinary curricular activity.

The approach to teaching and learning for sustainable development described here perhaps takes us a little closer to Laszlo's call for the fundamental new thinking that we shall need to live in the third millennium (Laszlo 1997). If our universities and colleges of higher education are to be the training grounds for the innovators of deep and far-reaching approaches to new ways of living, sharing and consuming, the institutions themselves need to examine their own practices and make the adjustments necessary. If the teaching staff can devise ways in which to successfully harness the creativity, time and effort of the student body towards this end, then synergies are released as the learning experience also becomes enriched; more meaningful, even transformative. To meet the ecological and social imperatives of rapidly finding ways of working towards a more just and sustainable global society all areas of human activity need to be re-considered, not least the way in which our colleges and universities run their affairs and practise their primary activity of teaching.

References

Ali Khan, S. 1995. Taking Responsibility, Promoting Sustainable Practice through Higher Education Curricula. London: Pluto Press.

Beard, C. and Wilson, J. 2001. The power of experiential learning. London: Kogan Page.

Cockrell, K.S., Caplow, J.A., Donaldson, J.F. 2000. 'A context for learning: collaborative groups in the problem-based learning environment'. The Review of Higher Education, 23 (3) 347-63.

Coppola, B.P. 1996. 'Progress in practice: teaching and learning with case studies'. The Chemical Educator, 1 (4) 1-13.

Design Council. 2002. Kit for Purpose: Design to Deliver Creative Learning. London: Good News Press Limited.

DFES (Department for Education and Skills, U.K. Goverment). Sustainable Development. <http://www.dfes.gov.uk/aboutus/sd>. (Accessed: March 20th 2006).

Einstein, D. 1993. The Campus Ecology Research Project: An Environmental Education Case Study. <http://www.fpm.wisc.edu/campusecology/cerp/thesis/3_cerp.htm>. (Accessed: September 11th 2001).

Grant, B. 1999. Campus Ecology and Environmental Stewardship.
<http://www.science.widener.edu/~grant/courses/campus/seEds.99/campuseEds.01.html>. (Accessed: March 16th 2001).

Herrmann, M. & Mullins, J. 2002. 'Making a Piece of the World Work: A Radical Pedagogy for Sustainable Design Education' Environments by Design, 4 (2) 45-61. UK: Kingston University Press.

Huckle, J. & Sterling, S. 1996. Education for Sustainability. London: Earthscan Publications Ltd.

Kolb, D. 1984. Experiential Learning as the Source of Learning and Development. Englewood Cliffs, NJ: Prentice-Hall.

Laszlo, E. 1997. Third Millennium – The Challenge and the Vision. Stroud: Gaia Books.

McDonough, W. 2000. University of Virginia, Institute for Sustainable Design; Sustainability Indicators Toolkit. Source: <http://www.virginia.edu/~sustain/piedmont/mapping.html>. (Accessed: 15th May 2000).

Orr, D. 1992. Ecological Literacy: Education and the Transition to a Postmodern World. Albany: State University of New York Press.

Richardson, J., Irwin, T., Sherwin, C. 2005. Design & Sustainability: A Scoping Report for the Sustainable Design Forum. London: Design Council.

Sterling, S. 2001. Sustainable Education: Re-visioning Learning and Change. Totnes: Green Books Ltd.
Sterling, S. 2002. 'A Baker's Dozen-towards changing our "loaf"' in The Trumpeter.
http://trumpeter.athabascau.ca/content/v18.1/sterling.html. (Accessed: 20th January 2006).
Sterling, S. 2003. Whole Systems Thinking as a Basis for Paradigm Change in Education: Explorations in the Context of Sustainability. University of Bath: PhD Thesis.